UNIVERSITI PUTRA MALAYSIA

EFFECTS OF SITES, FERTILISERS AND LIGHT ON THE GROWTH OF CALAMUS MANAN MIQUEL

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EFFECTS OF SITES, FERTILISERS AND LIGHT ON THE GROWTH OF *CALAMUS MANAN* MIQUEL

By

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Calamus manan Miquel is one of the most important rattan species which is being used for furniture manufacturing. Planting of *C. manan* is being widely promoted to meet the increased demand. The silvicultural requirements of the species have not been well defined. The objective of this study was to evaluate the effects of site, fertilisers and light on the growth of *C. manan.*

The study consisted of three components. The first examined the growth performance on three different sites namely Ulu Seraja, Kota, Ulu Cheka and Serting. The second involved a pot trial examining the effects of chicken dung, POME and NPK (blue) under two light intensities, 100% and 50%. The third was on fertiliser field trials examining the benefit of applying slow release fertilisers and applying fertiliser at an age beyond three years as commonly practised.

The results showed that *C. manan* planted at Ulu Cheka grew better compared to the other sites. The soil at Ulu Cheka was of Typic Paleudult with well drained condition and clay texture. This together with good management in terms of weed control could be the contributory factor in promoting good growth.

The results of the pot experiment showed that fertilised plants grew better than unfertilised plants under both 100% and 50% light intensities. Among the fertiliser treatments, chicken dung promoted the best growth, following by POME and finally NPK (blue). Seedlings grown under full sun light were generally bigger than those 50% light intensity in terms of biomass. The reverse was true for height and diameter growths, with values higher in 50% light intensity. Those seedlings applied with chicken dung also had a higher rate of photosynthetic rate than those applied with POME, NPK and control respectively.

From the field trials it was found that the response to fertiliser as a percentage of control for both height and diameter increments was slightly better in three year old than in the four year old plants, suggesting that applying fertiliser on *C. manan* beyond the age of three years may not be beneficial. It was also found that slow release fertilisers general gave better growth in terms of height and diameter increments than the normal fertiliser. Among the slow release fertilisers tested Apex (14:14:14) was found to promote the highest growth.

It can be concluded that growth of *C. manan* can be affected by site, fertiliser and light. The implications of this on the cultivation of *C. manan* is discussed.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

KESAN TAPAK, BAJA DAN CAHAYA KE ATAS PERTUMBUHAN ROTAN *CALAMUS MANAN* MIQUEL

Oleh

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Calamus manan Miquel adalah salah satu spesies rotan yang penting dalam pembuatan perabot. Penanaman spesies rotan ini digiatkan untuk memenuhi permintaan. Keperluan silvikultur spesies ini masih belum diketahui sepenuhnya. Objektif kajian adalah untuk menilai kesan tapak, baja dan cahaya ke atas pertumbuhan *C. manan.*

Kajian ini mengandungi tiga komponen. Pertama, menilai prestasi pertumbuhan di tiga tapak yang berbeza iaitu Ulu Seraja, Kota, Ulu Cheka dan Serting. Kedua, melibatkan percubaan pasu untuk menilai kesan baja tahi ayam, POME dan NPK (blue) di bawah dua keamatan cahaya iaitu 50% dan 100%. Ketiga, percubaan baja di lapangan untuk menilai keberkesanan penggunaan baja perlepasan perlahan atau penggunaan baja pada umur selepas tiga tahun seperti yang biasa digunakan.

Keputusan menunjukkan bahawa spesies *C. manan* yang ditanam di Ulu Cheka tumbuh lebih baik berbanding dengan kawasan lain. Tanah di sini ialah Typic Paneudult

yang bersaliran dan bertekstur baik. Ini disertai dengan pengurusan yang baik dari segi kawalan rumpai turut menyumbangkan kepada peningkatan pertumbuhan yang baik.

Keputusan bagi ujian pasu menunjukkan bahawa tumbuhan berbaja tumbuh dengan baik berbanding dengan tumbuhan tidak berbaja dibawah intensiti cahaya 50% dan 100%. Di antara rawatan baja, tahi ayam mengiatkan pertumbuhan yang terbaik diikuti dengan POME dan akhirnya NPK (blue). Dari segi biojisim, anak pokok tumbuh dibawah cahaya matahari penuh akan tumbuh dengan baik jika dibandingkan dengan 50% cahaya. Namun, nilai pertumhuhan bagi tinggi dan diameter akan lebih untuk anak pokok yang tumbuh dibawah 50% cahaya. Ia juga mempunyai kadar fotosintesis yang lebih tinggi apabila baja tahi ayam digunakan dibandingkan dengan baja-baja lain.

Berdasarkan dari percubaan lapangan didapati bahawa tindakbalas terhadap baja sebagai peratusan keatas kawalan pertambahan tinggi dan diameter adalah lebih baik pada umur tiga tahun berbanding dengan pokok berumur empat tahun. Ini bermakna cadangan penggunaan baja pada *C. manan* selepas umur tiga tahun tidak berfaedah. Kajian juga mendapati bahawa baja pelepasan perlahan secara amnya memberi pertumbuhan yang baik dari segi pertambahan ketinggian dan diameter dibandingkan dengan baja biasa. Di antara baja pelepasan perlahan yang diuji Apex (14:14:14) didapati menggalakkan pertumbuhan tertinggi.

Kesimpulan boleh dibuat bahawa pertumbuhan *C. manan* boleh dipengaruhi oleh tempat, baja dan cahaya. Oleh itu, implikasinya terhadap penanaman *C. manan* dibincangkan.

CHAPTER I

INTRODUCTION

The name 'rattan' originates from the Malay word 'rotan' meaning the stem of a climbing palm. Rattans are spiny climbing palms. There are about 600 species concentrated in Southeast Asia. In Peninsular Malaysia, 107 species belonging to ten genera have been documented (Aminuddin and Salleh, 1994).

In a rattan plant, the stem is covered by spine-bearing leaf sheaths. When the stem matures, the leaf sheaths detach and eventually drop off. It is the bare rattan stem that is used in the construction of cane furniture (rattan sticks, cane, core and split cane are used). In rural areas, both large and slender rattans are used for numerous purposes such as house-building, bridges, twine for tying, ropes and fish traps.

Rattan stems are important forest products in Southeast Asia. There is a great demand for rattan furniture in the local as well as international markets. Therefore, rattan enters the world market as rattan cane, core, stocks and split cane, and raw materials for the cane furniture construction. Raw materials are said to bring US $50 million into village economies, annually and the value of manufactured products reaching consumers is about US$1.2 billion (Menon, 1980). From a total of about 600 species found in the world, only about 20 species are being commercialised in Peninsular Malaysia (Manokaran, 1985a).

Calamus manan Miq. is a large diameter cane having sizes more than 18 mm in diameter. It is one of the most important raw materials in the manufacture of cane furniture. It is found in abundance only on the Malay Peninsula and Sumatra but not in Borneo.

In recent years, the demand for rattan has been increasing (Manokaran, 1990). This has resulted in an increase in harvesting rate, therefore, severely depleting supplies in the wild. With the increasing demand for large diameter canes such as *C. manan* in local and international markets, steps have to be taken to establish large scale plantations to meet the need. To conduct large scale plantings, knowledge of silviculture and growth of the species is very important. Therefore, research on this species has been done country-wide to raise the supply instead of obtaining from the wild.

In the past few years, researchers have worked on many aspects of rattan such as taxonomy (Dransfield, 1973, 1979, 1980a, 1985a), seed storage, germination and ecological studies (Generalao, 1977, Manokaran 1978; Darus, 1983; Darus and Aminah, 1985; Vongkhaluang, 1985; Aminuddin, 1987; Aminuddin, 1990). More studies are necessary considering that rattan is an important non-wood forest product which can be used for many purposes such as cane furniture.

Statement of Problem

Many rattan species are now facing depletion and are endangered. Steps have begun to be taken by the governments and private sector agencies in the region to plant rattan on large scales. Although great advances have been made

in our understanding of rattan as a potential plantation crop there is still much that is unknown and knowledge on the silviculture of the species is insufficient.

Various large scale plantations of commercially important rattans have been established in Malaysia by several agencies. Every year, Forestry Departments in Peninsular Malaysia are planting at the rate of 1000 ha. Likewise, the private sector has also started to plant *C. manan* especially in rubber areas such as at Syarikat Kurnia Setia in Pahang. In Sabah, about 10,000 of rotan irit (*Calamus trachycoleus*) has been planted and about 3000 ha of rotan batu (*C. subbinermis*) and rotan manau (*C. manan*) being planted (Aminuddin and Salleh, 1994). In addition, plantings particularly with *C. manan* in small holdings are also taking place in the country. This is normally intercropped with rubber trees.

For the past few years, researchers have worked on various aspects of rattan research such as taxonomy, seed storage and germination studies. Knowledge of silvicultural requirements has yet to be documented comprehensively. As more rattans are being planted as agroforestry components, steps must be taken to investigate the site requirements for better growth of the species. The growth of rattan at different ages and the effect of light and fertiliser applied at different growth stages are some aspects that are not well known.

This study will examine the effects of sites, fertilisers and light on the growth of *C. manan* Miquel.

Objectives of Study

The main objectives of the study were to evaluate:

(i) the growth performance of *C. manan* at four different sites; Serting and Kota (Negeri Sembilan), Ulu Seraja (Malacca), Ulu Cheka (Pahang).

(ii) the effects of light and fertilizer on the growth of *C. manan* seedlings under green house.

(iii) the growth response of *C. manan* to different fertilizers and when applied at different ages in the field.

CHAPTER II
LITERATURE REVIEW

Rattan Taxa

In the tropical forest, rattans are recognised as climbing palms which belong to the *Palmae* or *Arecaceae* family. There are about 600 different rattan species found in 14 genera. They are grouped under the large sub-family of the palms known as the *Calamoideae* (Uhl and Dransfield, 1987). The genera described are *Laccosperma, Eremospatha, Korthalsia, Daemonorops, Calamus, Calospatha, Pogonotium, Ceratolobus, Retispatha, Plectocomia, Plectocomiopsis, Myrialepsis, Oncocalumus,* and *Salacca* (Dransfield, 1979; 1980a,b; 1992, Uhl and Dransfield, 1987).

Out of the 14 rattan genera found worldwide, three are found only in the equatorial rain forest of Africa and the remaining eleven are confined to the Asian region (Dransfield, 1992). Among the eleven genera, *Calamus* is probably the richest genus which comprises about 370 species and the main diversity is in the Malay Peninsula and Borneo.

Calamus can be differentiated from the other genera based on a number of combined characters. The most reliable character is the tabular persistent nature of the inflorescence bracts. Apart from this, some characters include the cirrus, leaves which are sub cirrate are nearly always species of *Calamus*, and ocrea which is some time highly developed (Dransfield, 1979).

Calamus manan Miquel, which is the subject of this study has been well described by Dransfield (1979). It is a solitary, massive high climbing rattan reaching over 100 m. Stems without sheaths can grow up to 8 cm in diameter. They are sometimes quite slender (2.5 cm) at the very base, and those with sheaths can grow up to 11 cm in diameter; internodes extending to 40 cm long. Sheaths are dull grey green, developed from a soft meristematic areas at it base. Leaf sheaths almost spiny. The spines arranged in length from 1 mm to 3 mm or longer. Ocrea is ill-defined. Rattan leaf is basically pinnate, rather than palmate. Leaflets come from the splitting of the folded leaf blade. The leaflets may be arranged regularly or irregularly. Regular arrangement produces an uninterrupted, even, series of leaflets along each side of the rachis. In irregularly arranged leaflets there may be an interrupted series of leaflets or the leaflets may be grouped or even paired. Normally, there are two main methods of rattan flowering that is Hapaxanthic and Pleonanthic. In Hapaxanthic flowering, the apex becomes exhausted after flowering and fruiting then the cane dies, usually to be reproduced by sucker shoots from the base. In Pleonanthic flowering, inflorescences are produced continually and flowering and fruiting not resulting in the exhaustion of the apex. Ripe fruits are rounded to ovoid, to 2.8 cm long by 2.0 cm wide shortly beaked, and covered in 15 vertical rows of yellowish scales with blackish brown margins. Seed ovoid, to 1.8 cm long by 1.2 cm wide, with finely pitted surface; endorsperm densely and deeply ruminate.

C. manan is variable in size and colouration. Pioneers sometimes confuse *C. manan* with *C. ornatus Blume* which is often very large and grows with it. However, it is immediately noticed because *C. manan* has a cirrus but no flagellum whereas *C. ornatus* has no cirrus but is very large in flagellum. *C. tumidus* is very close to *C. manan* but can be distinguished on its smaller size, different leaf sheath armature and the very large bulbous, swollen knee (Dransfield, 1979).

Rattan Distribution

Rattans have a wide distribution range. They are found extending from west Africa to Fiji and from south China to Queensland, Australia (Menon, 1980). There are about 600 species and 14 genera found in the world, 107 species (ten genera) are indicated in Peninsular Malaysia (Uhl and Dransfield, 1987).

Malaysia is known to be the centre of diversity. About 10 genera are found in Malaysia and other neighbouring countries such as Thailand, Indonesia (Sumatra, Borneo), Sri Lanka, the Indian sub-continent, southern China, Burma, Vietnam, Laos, Cambodia, Philippines, New Guinea, Fiji, and Australia (Dransfield, 1979, 1980a, 1980b).

In India, about 49 taxa in 5 genera have been documented (Basu, 1992). These genera include *Korthalsia, Plectocomia, Daemonorops, Calamus* and *Salacca*. Out of these 49 taxa, just only one is a stemless palm. The other 48 taxa are mostly climbers and constitute nearly half of the total palm family in India (Basu, 1992). The diversity among the Indian rattans is